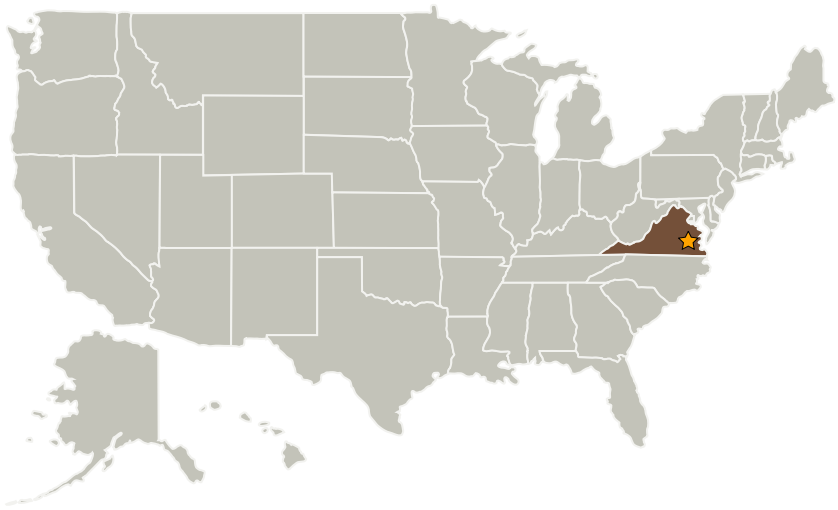
Advanced Photon-Counting Detector Subsystem for Spaceborne Lidar Applications

Completed Technology Project (2018 - 2020)

Project Introduction

We propose to develop low-noise, high-efficiency, and high-dynamic-range lidar detector technology that will significantly enhance the performance of lidars designed for aerosol, cloud, and ocean profiling. The requirements for our project are derived from a spaceborne lidar concept developed in response to the 2007 Decadal Survey for Earth Science and Applications from Space and a current international spaceborne lidar concept study. The new detector technology will enable the first-ever ocean profiling lidar from space and advanced retrievals of dense cloud properties. The driving requirements concern the large dynamic range, high vertical resolution, and fast transient recovery required of the detection system for ocean and cloud profiling. Our approach involves the use of an array of mature silicon photomultiplier detectors and development of a custom Read-Out Integrated Circuit (ROIC) that records photo-electron events at 10-ns resolution from each detector in the array and sums those values for each time bin to produce a single profile. This approach achieves (1) a dynamic range that is orders of magnitude higher than current photon counting schemes (2) provides the temporal resolution to achieve < 2-m vertical resolution, and (3) and has transient recovery characteristics required to accurately profile clouds and the near-surface ocean for which the measured signals attenuate extremely rapidly with depth. Moreover, this technology is also broadly applicable to ground-, aircraft-, and space-based direct detection lidars operating in the 355-900 nm wavelength range, including differential absorption lidars and direct detection wind lidars.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Advanced Component Technology Program

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Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations
Virginia

Project Management

Program Director:

Pamela S Millar

Program Manager:

Amber E Emory

Principal Investigator:

John A Smith

Co-Investigators:

Rebecca W Bales
Richard J Hare
Chris A Hostetler

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers

Target Destination

Earth